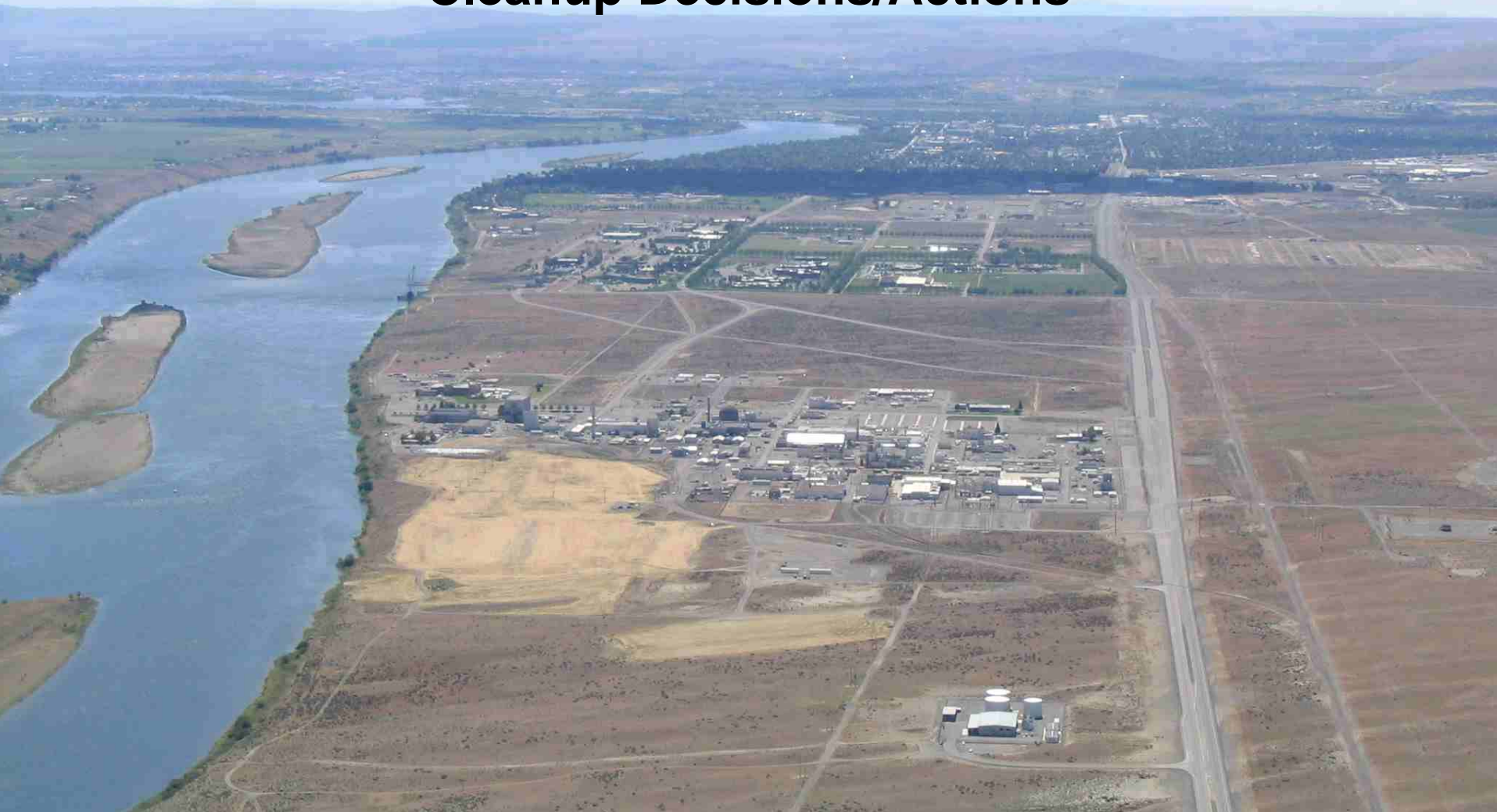


300 Area Workshop

**Status & Path-Forward for Groundwater
Cleanup Decisions/Actions**



Workshop Objectives

- Discuss the history, current status and plans to achieve 300 Area groundwater remedial decisions under CERCLA
- Discuss the results of the limited field investigation
- Discuss the status of the remedial technology down-select process
- Discuss the status of the treatability test for polyphosphate sequestration
- Discuss integration with the 300 Area Integrated Field Challenge
- 300 Area Risk Assessment will be deferred to a later time

300 Area NPL Site:

- **Operable Units**

- Two waste source operable units: 300-FF-1 and 300-FF-2.
- 300-FF-5 operable Unit includes the groundwater affected by releases from the source operable units.

- **300 Area Sub-Region**

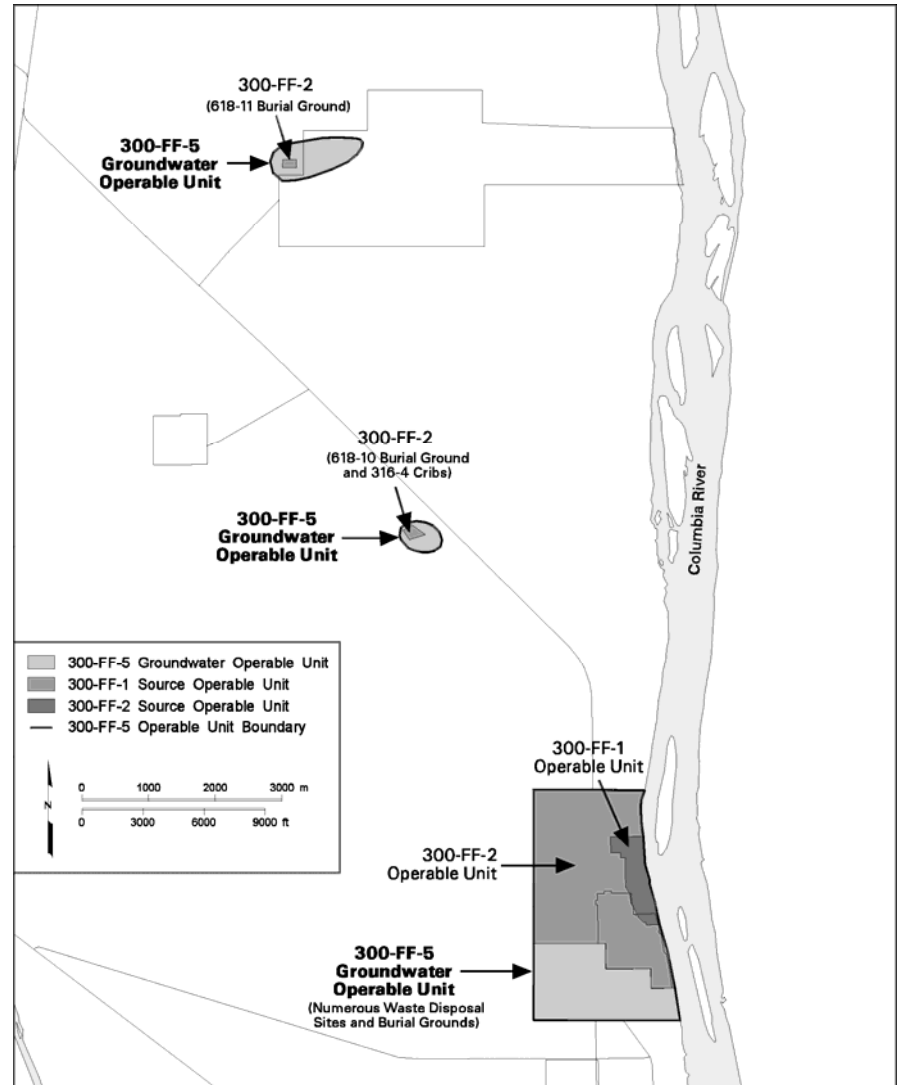
- Large liquid waste disposal sites and burial grounds.
- Includes vadose zone beneath remediated sites.
- Contaminated fuels fabrication and research facilities.

- **618-11 Sub-Region**

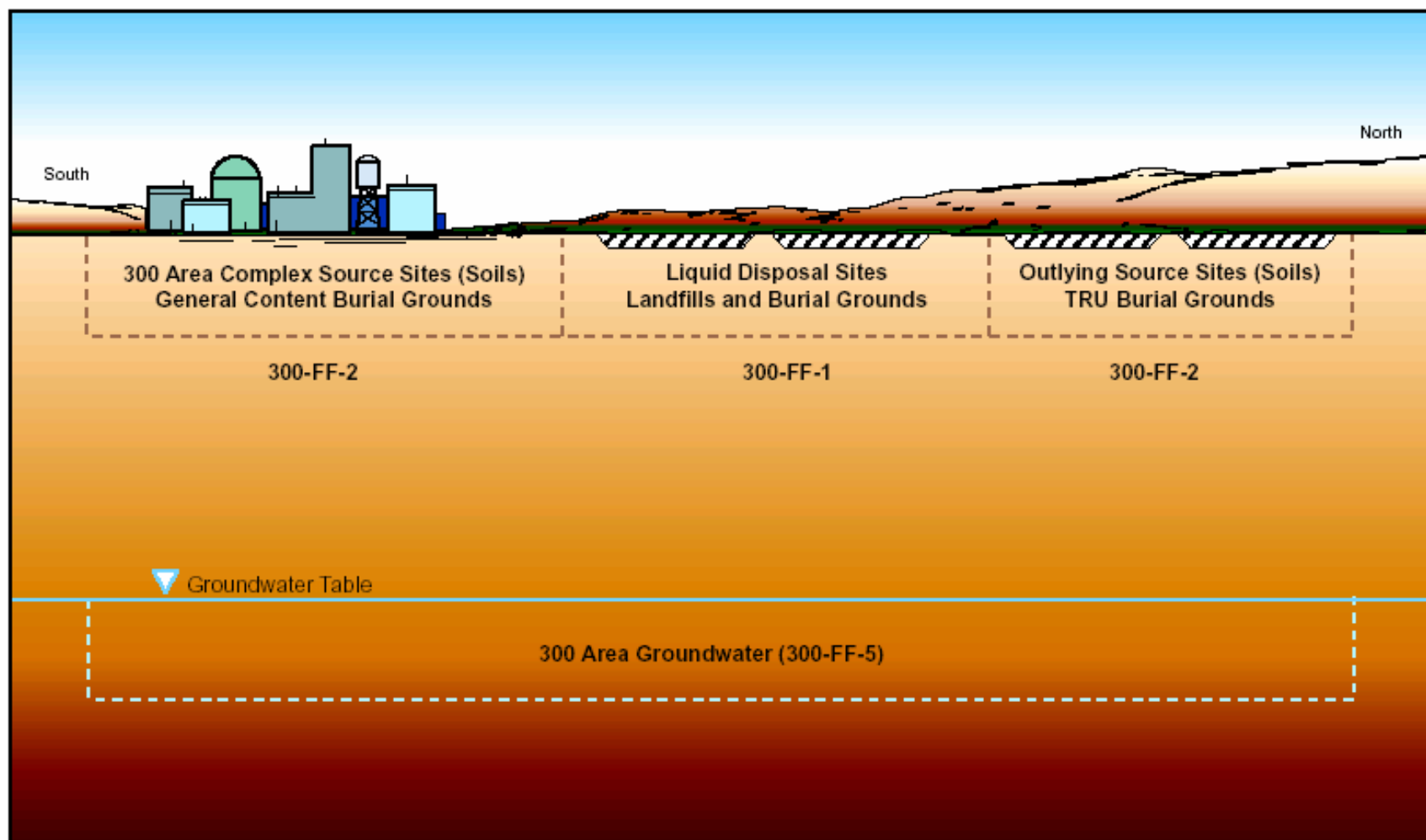
- 618-11 burial ground.

- **618-10 / 316-4 Sub-Region**

- 618-10 burial ground and former 316-4 cribs.



Source: Modified from PNNL-15070



Decontamination and Decommissioning of Buildings in the 300 Area Complex will be addressed through CERCLA removal authority.

E0005076

Note: Generalized Cross-Section Not Drawn to Scale.

Snapshot of 300 Area

- 0.25 sq mile industrial complex area and surrounding locations
- Approx 150 buildings and structures
- Approx 70 soil waste sites including:
 - 40-50 soil contamination areas inside the complex underneath buildings and roadways
 - 32 miles of underground piping
 - Liquid disposal sites
 - Solid waste disposal sites
- 300 Area placed on National Priorities List (1989)
 - Requires cleanup
- CERCLA Records of Decision (1996 and 2001)
 - Define cleanup requirements
 - Two CERCLA Five-Year Reviews

CONTAMINANTS OF CONCERN: 300 AREA

- **Contaminants of concern, as identified in decision documents, are:**
 - Uranium, trichloroethene, and cis-1,2-dichloroethene (ROD 1996)
 - 74,000-134,000 pounds of uranium discharged to North & South Process Ponds between 1943-1975
- **Additional contaminants of potential concern include:**
 - Localized occurrences of tetrachloroethene and strontium-90
 - Nitrate and tritium, which migrate into the area from non-300 NPL Site sources
- **Information on current levels of these waste constituents, along with their annual maximum values since 1992, are provided in:**
 - *Contaminants of Potential Concern for the 300-FF-5 Operable Unit: Expanded Groundwater Report for FY 2004 (PNNL-15127, March 2005)*



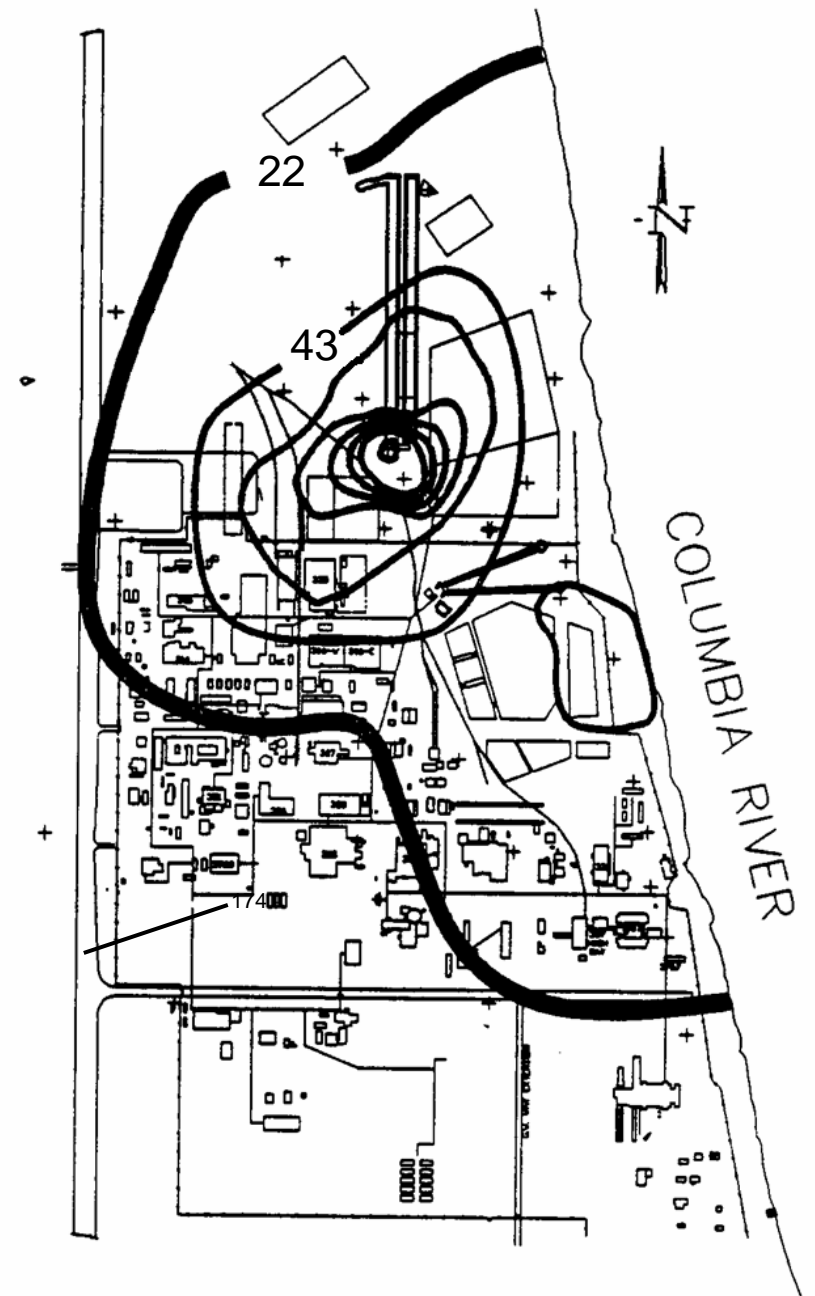
1967 – Core Area and North



1979 – With Process Trenches in Use

1990 Uranium Plume

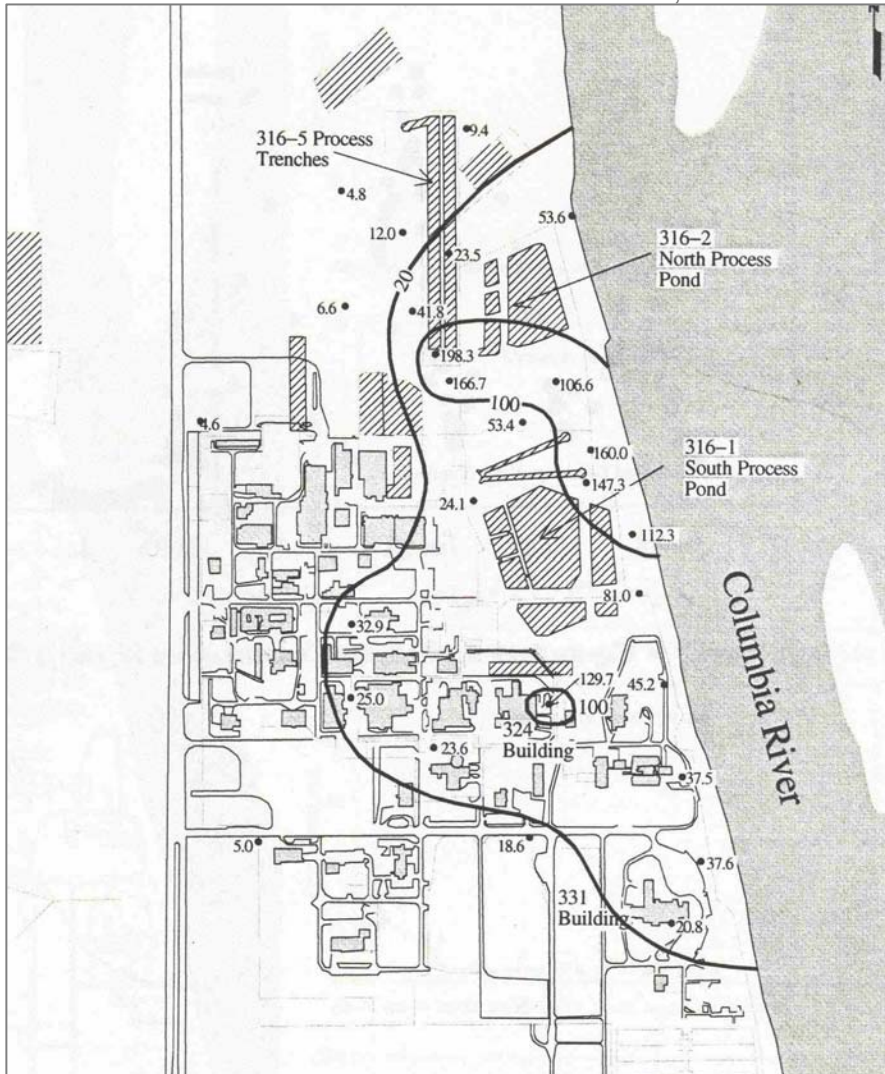
- Large area exceeding current drinking water standard (MCL) of 30 ug/L (~22 pCi/L)
- Hot spot at south end of 316-5 trenches at high river stage
 - Parallel trenches received process sewer wastes from 1975 to 1994
 - Process wastewater contained very little uranium by the late 1980s
- 1993 groundwater flow and uranium transport analysis predicted cleanup to < 20 ug/L (earlier standard) in 3 to 10 years



1990 Uranium (pCi/L)

The Conceptual Model for the Existing Remedial Decisions

300 Area Uranium Plume, 1995



- Most of the U mass is in the 1st few feet of sediments in the liquid waste disposal sites
- Remove this source and the U concentrations will attenuate to < DWS.
- Expedited Response Action in 1991 removed contaminated soil from trenches with dramatic U concentration decreases.
- The RI/FS Report (May 1995) suggested that the plume would attenuate to meet the drinking water standard in 3 to 10 years from late 1993.
- A Record-of-Decision was made in 1996 with that assumption.

1993 Numerical Model

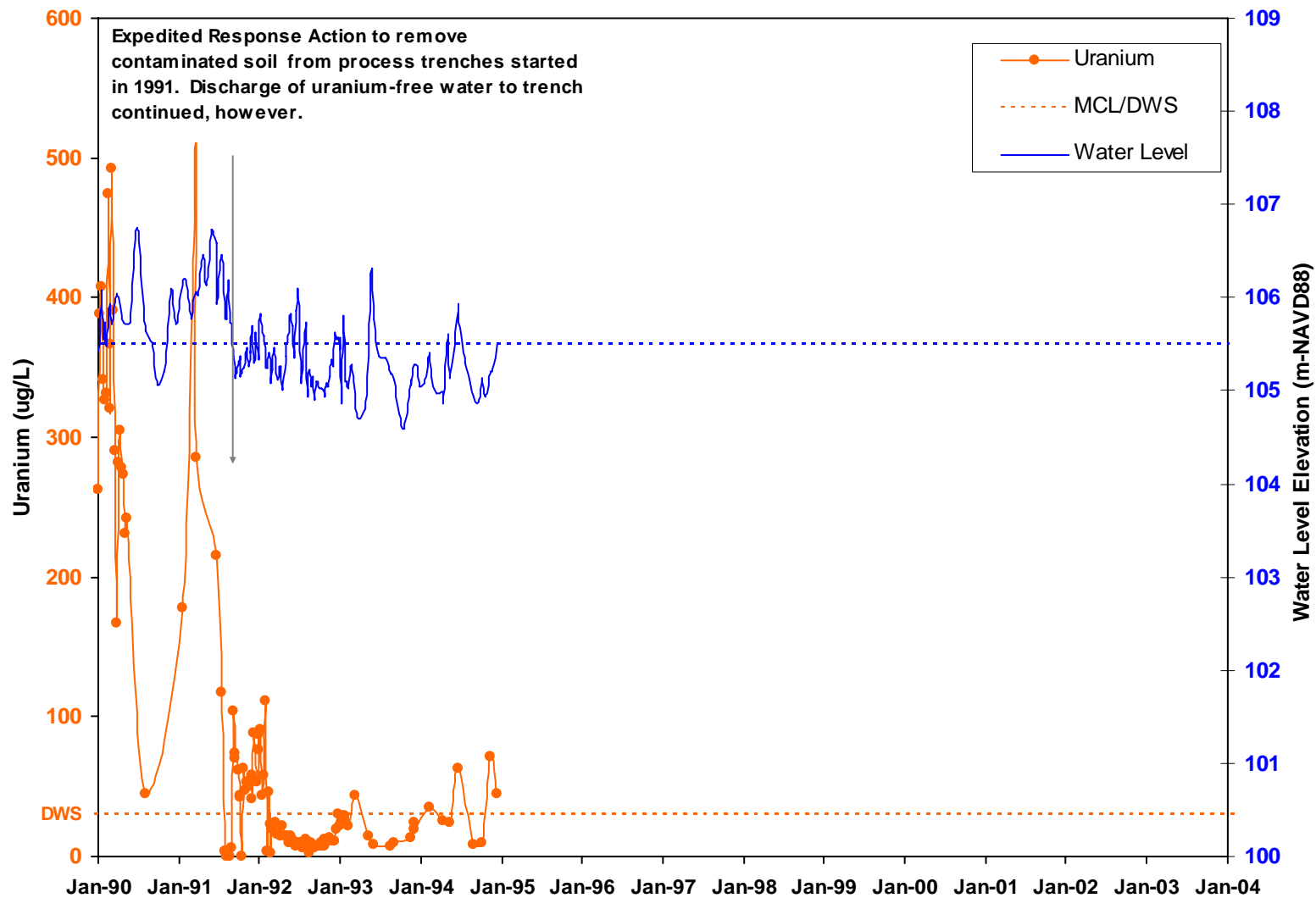
Modeling Assumptions in Phase I Remedial Investigation (1994)

- 3-D saturated unconfined aquifer; **vadose zone not modeled**
 - Spatially distributed hydraulic conductivity (4 hydrofacies types)
 - Flow field driven by **monthly** changes in river stage fluctuations
 - Uranium mobility controlled by **constant K_d**
 - Natural flushing predicted to largely decrease U to < 20 ug/L by 2018 (end of institutional controls)

Prediction Update for $U < 20$ ug/L in RI/FS (1995)

- “Refinement” of Phase I RI estimate: **3 to 10 years** from late 1993 to meet standard
- Analytical model assumptions
 - **Steady-state saturated flow**
 - **Constant hydraulic conductivity: 1830 m/day**
 - **Constant hydraulic gradient: 5×10^{-4}**
 - 500 m travel distance from process trenches to Columbia River
 - Uranium mobility controlled by “best estimate” **constant $K_d \sim 1$ to 2 mL/g**
- **No interaction between aquifer and river**
- **No interaction between aquifer and vadose zone**

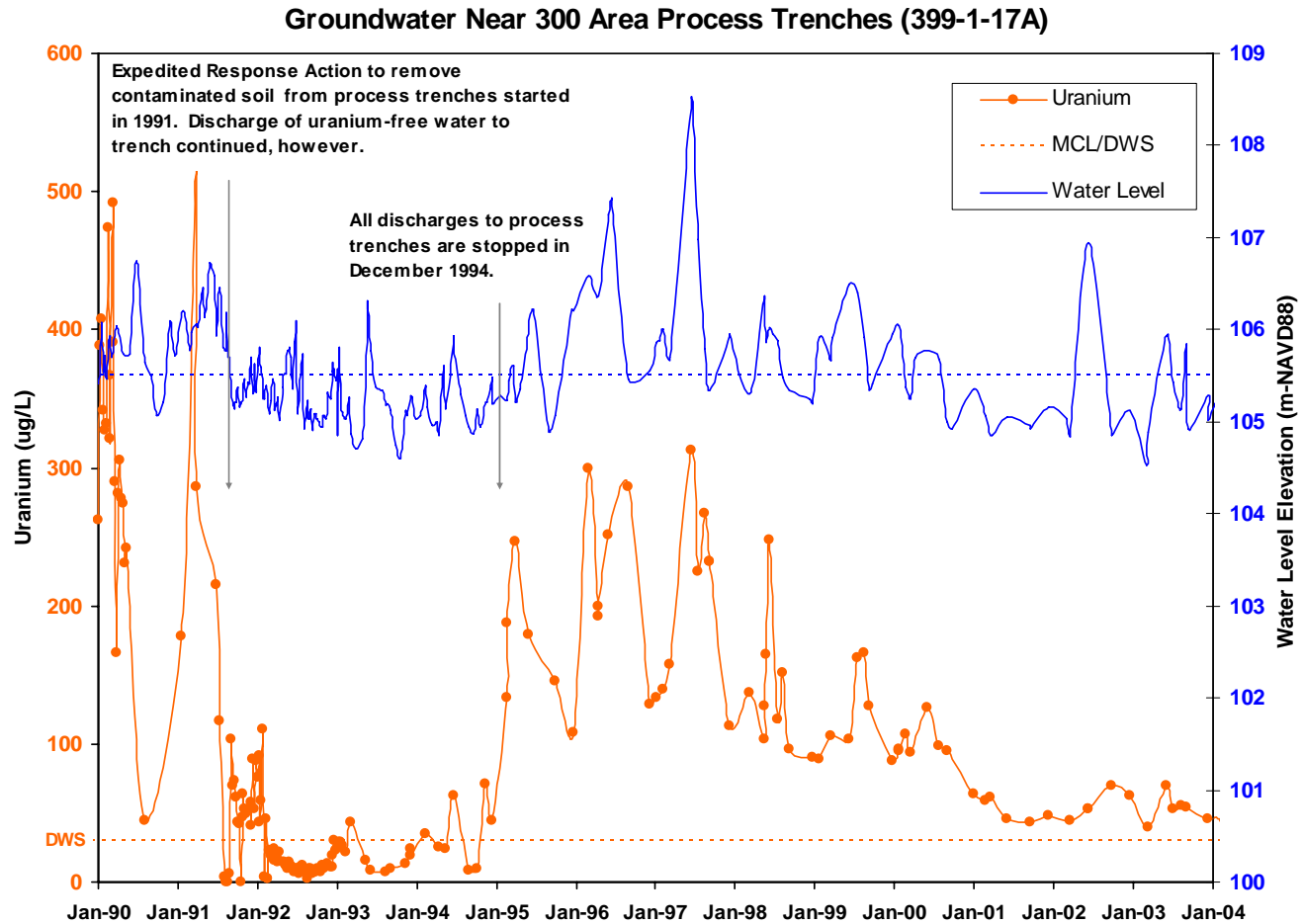
Groundwater Near 300 Area Process Trenches (399-1-17A)



300-FF-05 Record of Decision

- The 300-FF-5 CERCLA Record of Decision (ROD), July 1996, selected groundwater monitoring and natural attenuation as the interim remedial action.
- The decision to select natural attenuation was based on the 300-FF-05 RI/FS that predicted the Remedial Action Objective (RAO) of meeting the drinking water standard for uranium would be attained in 3 to 10 years (from late 1993).
- The IROD requires continued groundwater monitoring “to verify modeled predictions of contaminant attenuation and to evaluate the need for active remedial measures”.
- The IROD also requires that, “If monitoring does not confirm the predicted decrease of contaminant levels, DOE and EPA will evaluate the need to perform additional response actions.”

“The Rest of the Story”



300-FF-05 ESD

- In June 2000 an “Explanation of Significant Difference” (ESD) to 300-FF-5 IROD was published.
- The ESD expanded the scope of IROD to address groundwater beneath 300-FF-2 waste sites (including 618-10, 618-11, and 316-4 crib).
 - The remedy, natural attenuation and continued groundwater monitoring, was not changed.
 - The 300-FF-05 Operable Unit boundary was expanded to include these outlying areas.
 - The 618-11 Burial Ground has a localized but highly concentrated tritium plume and the 618-10 Burial Ground and neighboring 316-4 Crib.
 - There has been no evidence of releases from the 618-10 Burial Ground. The monitoring well for the 316-4 Crib has detected uranium, total petroleum hydrocarbons and tributyl phosphate.
 - Contamination found at these facilities is localized and not expected to pose a threat to Columbia River.

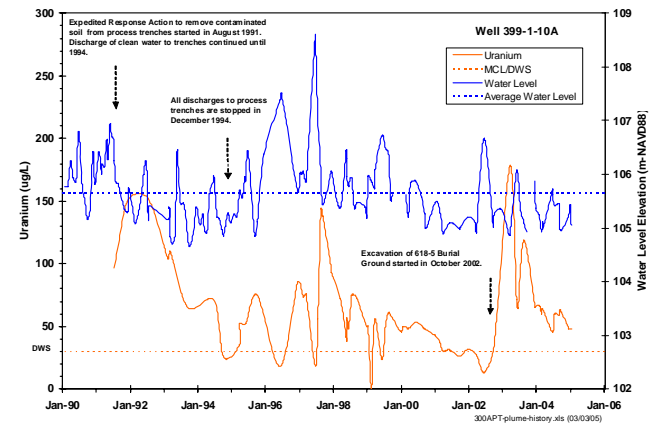
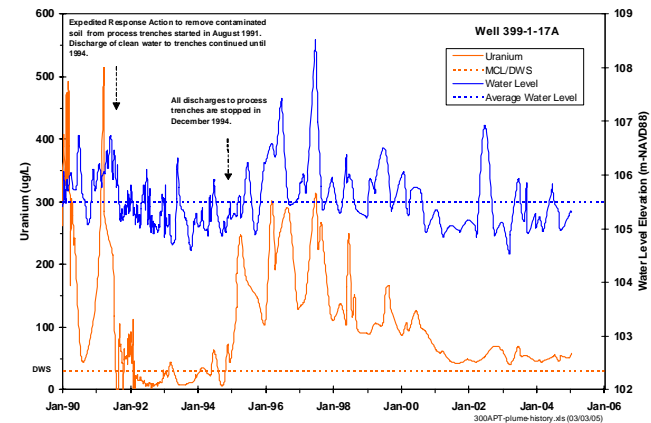
CERCLA Objectives for Groundwater Protection

“EPA expects to return usable ground waters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site. When restoration of ground water to beneficial uses is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated ground water, and evaluate further risk reduction”

– 40 CFR 300.430(a)(1)(iii)(F).

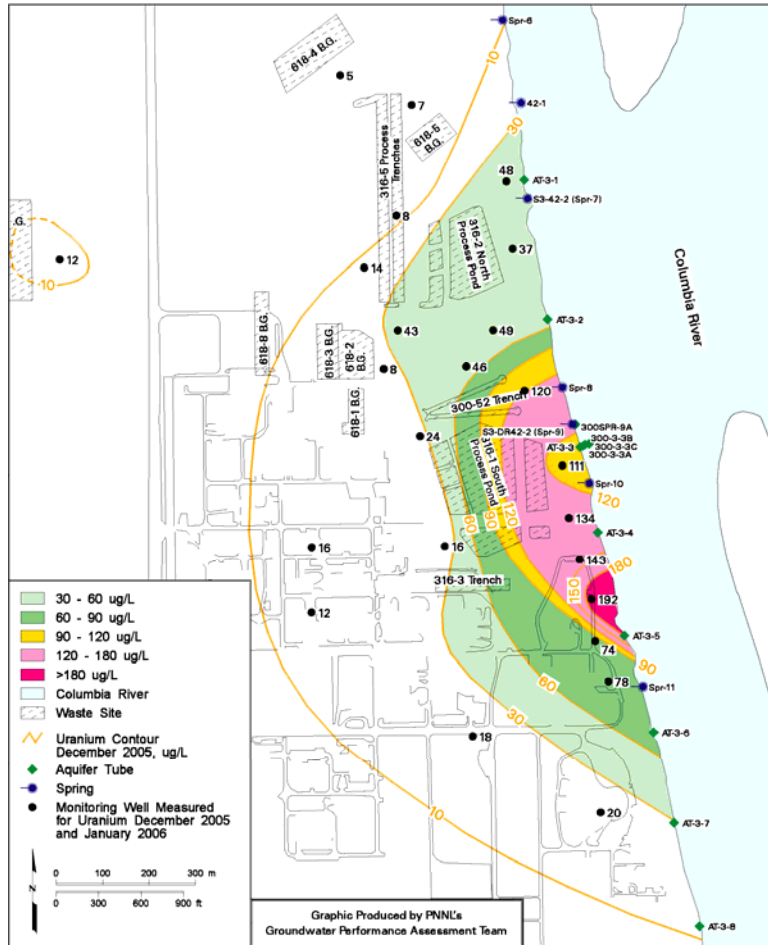
Uranium Responses Observed in 300 Area Groundwater

- U concentrations respond to river stage
- No observation of U concentration response to precipitation
- U concentrations respond to artificial infiltration

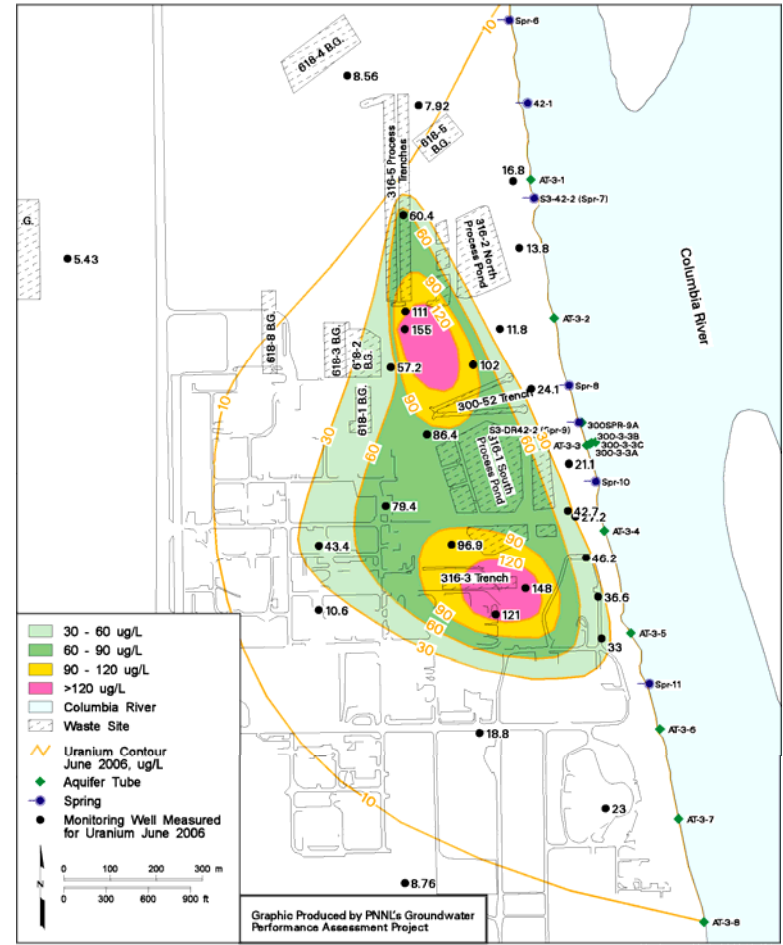


300 Area Uranium Plume, Recent Conditions

300 Area Uranium, December 2005

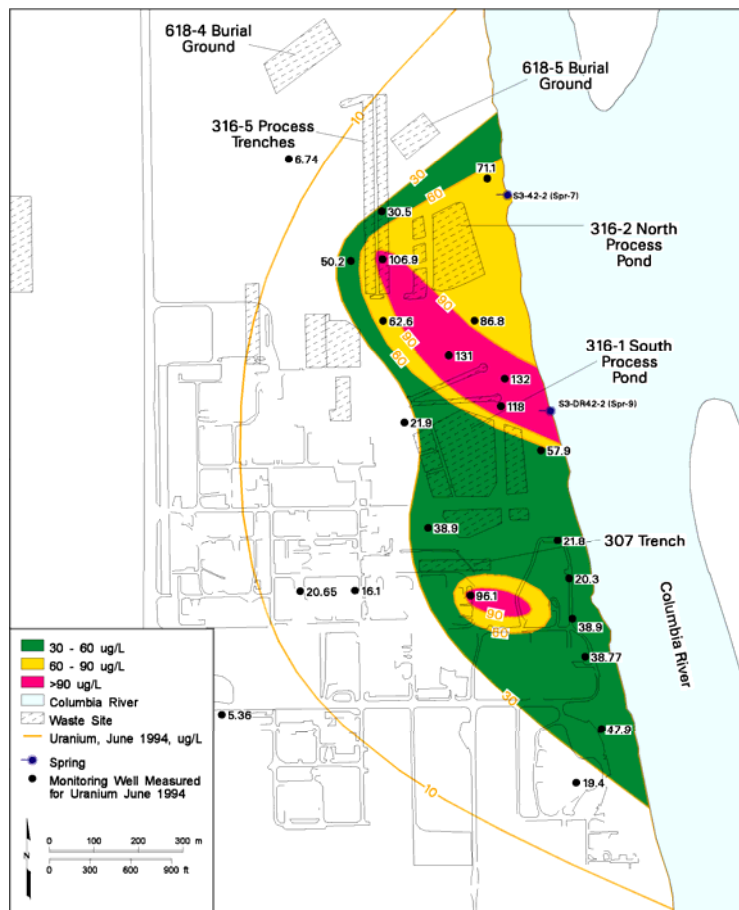


300 Area Uranium, June 2006

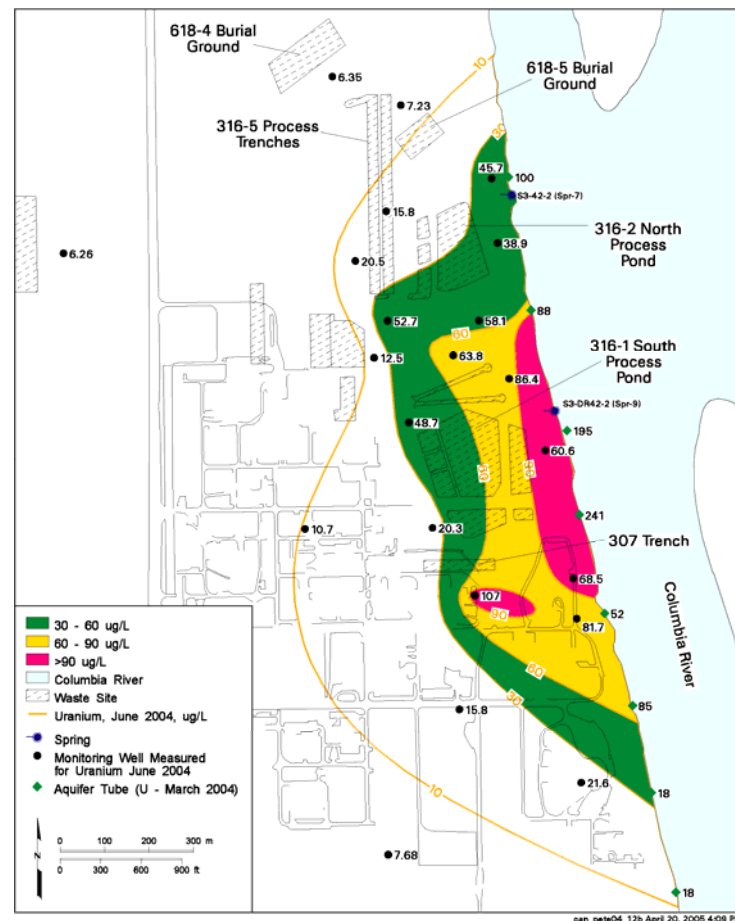


300 Area Uranium Plume Exceeding Current Drinking Water Standard 1994 & 2004

Shaded 300 Area Uranium, June 1994



Shaded 300 Area Uranium, June 2004



Conceptual Model for Uranium Transport to River Environment

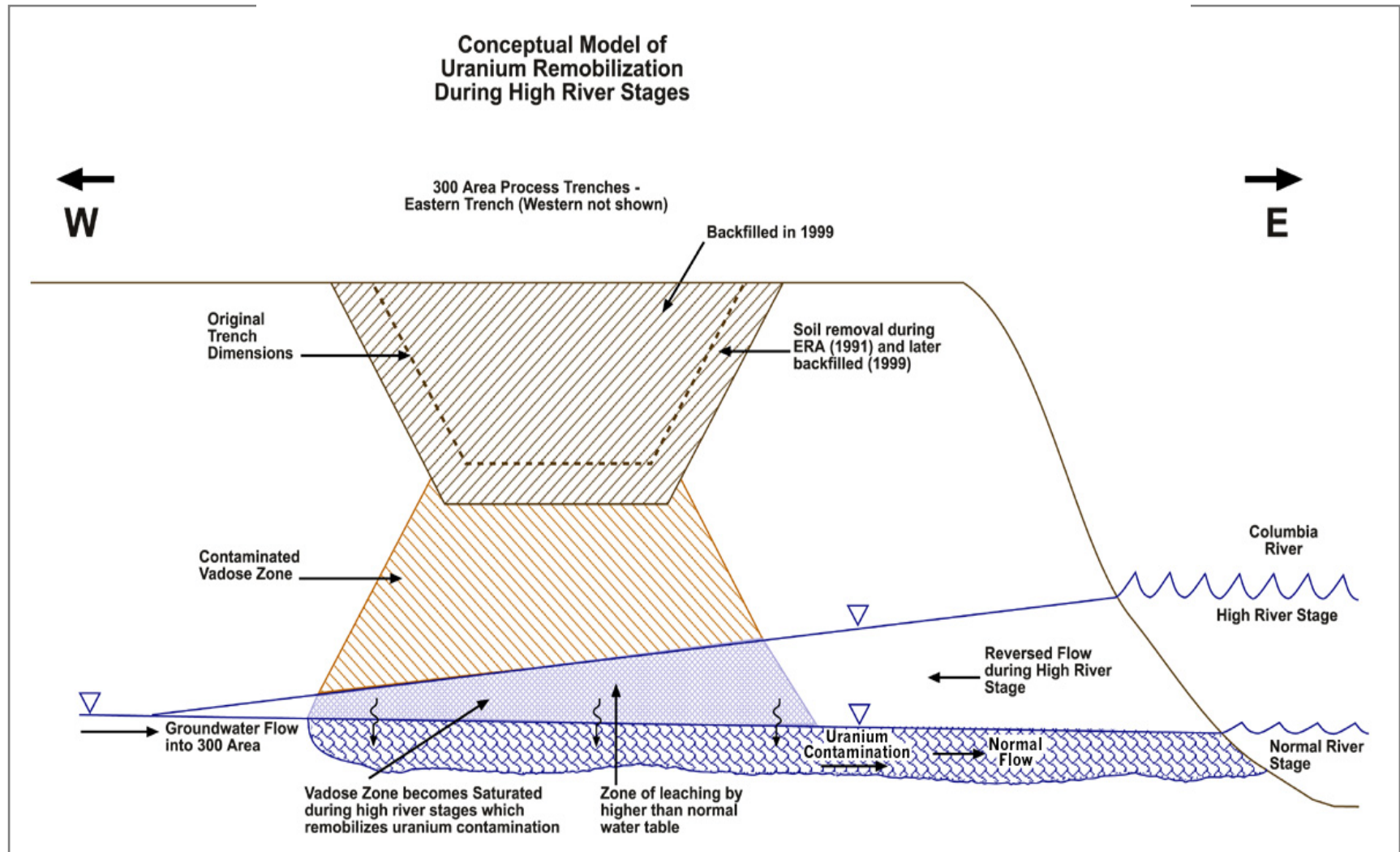


Figure Source: Lindberg 2002

ACTIVITIES SINCE ROD

- Remediation of principal 300 Area liquid waste disposal sites—excavation, characterization, backfilling, and surface restoration.
- Geochemical investigations as to the characteristics of uranium in the vadose zone and aquifer; field and laboratory.
- Computer simulations of groundwater flow and uranium transport.
- Intensive survey of 300 Area shoreline—cooperative effort involving PNNL and the State Department of Health.
- Installation of shoreline aquifer tubes and new monitoring well; *in situ* measurements that support groundwater/river interaction study.
- Review of concentration trends for all contaminants of potential concern for the period 1992 to 2004; analysis of natural attenuation processes.
- Limited Field Investigation (LFI) & Treatability Test.
- Two CERCLA Five-Year ROD reviews

Path Forward

- Two “Tracks”
 - “Short Track” Feasibility Study/Proposed Plan to address uranium
 - “Longer Track” Feasibility Study/Proposed Plan to address remaining contaminants of concern, including TCE
 - Detailed schedule to be provided at the end of the day